



UNIVERSITI PUTRA MALAYSIA

***PHYTOCHEMICAL COMPOUNDS IN CASSAVA (*Manihot esculenta* Crantz)
Var. MEDAN AND PONTIAN INFLUENCED BY SOURCES OF
FERTILIZER***

NUR FAEZAH BINTI OMAR

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**MASTER OF SCIENCE
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By

NUR FAEZAH BINTI OMAR

**Thesis Submitted to the School of Graduate Studies, Universiti Putra
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February 2013

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

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NUR FAEZAH BINTI OMAR

February 2013

Chairman: Associate Professor Siti Aishah Hassan, PhD

Faculty: Agriculture

The level of phytochemicals in crops is affected by several factors such as genetic differences and environmental conditions. Nowadays health conscious consumers are interested in optimizing the nutritional composition of foods produced through environmentally friendly. Therefore, a study was conducted with the objectives of determining the phytochemical contents of *Manihot esculenta* as affected by varieties and sources of fertilizer.

Planting materials collected from MARDI Jalan Kebun were used in this study. Genomic DNA was extracted from leaf samples using GeneAll Plant DNA extraction kit and a total of eight simple sequence repeats (SSR) primers were used. The genetic similarities among the planting materials were estimated using the Jaccard's coefficients. The study revealed that number of polymorphic loci is three which is equal to 36.5% of polymorphism between 30 samples (15 Medan and 15 Pontian). The low degree of variation represent that most of these samples were somaclonal

materials. The Jaccard similarity matrix ranged between 0.60-1.00, indicating a close relationship among the cassava genotype.

The field experiment was conducted at Field 10. Six treatments were arranged in randomized complete block split-plot design with three replications. The main plot was fertilizer sources consisting of vegetable waste vermicompost (2.32 %N: 1.54%P: 1.06%K), empty fruit bunch compost (1.46%N: 1.47%P: 2.58%K) and inorganic fertilizer (15%N: 6.55%P: 12.45%K). The sub plot based on Medan and Pontian varieties. The physiological activities were observed at 4 and 7 months after planting. The young leaves and tuber were harvested 9 months after planting and analyzed for the phytochemical compounds.

The highest yield and the largest tuber diameter were observed in inorganic fertilizer treated-plants. The highest chlorophyll obtained from vermicompost-treated plant. Among varieties, the highest yield was obtained from Pontian. There were positive interactions between the fertilizer sources and varieties in terms of yield, tuber diameter, relative chlorophyll content, stomatal conductance and photosynthetic rate.

The findings also showed that cassava treated with VWV gave the best performance on the ascorbic acid, total carotenoids, total phenolic compounds, and total flavonoid and antioxidant activities whereas, inorganic fertilizer increased the level of cyanogenic glycosides in tuber and leaves. Total phenolic and flavonoid content was found significantly higher ($P \leq 0.01$) in the VWV treatment than those in mineral fertilizer and EFBC. Total phenolic compounds increased by 15 % in the VWV-treated leaves and tuber compared to EBFC. Among varieties, Medan contained higher phytochemical content compared to Pontian.

The DPPH and FRAP scavenging activity had shown that Medan with the application of VWV exhibited a higher percent of inhibition. Application of vermicompost and EFBC can enhance antioxidant activities. Medan leaves exhibited significantly higher antioxidant activity than Pontian. Cyanide content in all treatments showed significant differences for both leaves and tuber. Relatively a lower amount of cyanogenic glycoside content was found in cassava where compost had been applied. In this study it is clear that fertilization and varieties have a pronounced influence on yield, physiological activities and phytochemical contents in cassava.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains

**KANDUNGAN FITOKIMIA DALAM UBI KAYU (*Manihot esculenta* Crantz)
Var. MEDAN DAN PONTIAN YANG DIPENGARUHI OLEH SUMBER
BAJA**

Oleh

NUR FAEZAH BINTI OMAR

Februari 2013

Pengerusi: Profesor Madya Siti Aishah Hassan, PhD

Fakulti: Pertanian

Tahap fitokimia dalam tanaman dipengaruhi oleh beberapa faktor seperti perbezaan genetik dan keadaan alam sekitar. Kini pengguna yang mementingkan kesihatan berminat dalam mengoptimumkan komposisi nutrisi makanan yang dihasilkan melalui mesra alam. Oleh itu, satu kajian telah dijalankan dengan objektif menentukan kandungan fitokimia *Manihot esculenta* seperti yang dipengaruhi oleh varieti dan sumber baja.

Bahan tanaman yang dikumpul daripada MARDI Jalan Kebun telah digunakan dalam kajian ini. DNA genomik diekstrak daripada sampel daun menggunakan kit pengekstrakan dan sejumlah lapan penanda SSR telah digunakan dalam kajian ini. Persamaan genetik antara aksesori dianggarkan menggunakan pekali Jaccard. Kajian ini menunjukkan bahawa bilangan lokus polimorfik adalah tiga yang bersamaan dengan 36.5% daripada polimorfisme antara 30 sampel (15 dan 15 Medan Pontian). Tahap variasi yang rendah mewakili kebanyakan sampel ialah bahan

somaklonal. Matriks persamaan Jaccard antara 0.60-1.00, menunjukkan hubungan yang rapat antara genotip ubi kayu.

Eksperimen lapangan dijalankan di Ladang 10. Enam rawatan telah disusun mengikut 'randomized complete block split-plot design' dengan tiga replikasi. Plot utama adalah sumber baja yang terdiri daripada sisa sayur-sayuran vermikompos (2.32% N: 1.54% P: 1.06% K), kompos tandan buah kosong (1.46% N: 1.47% P: 2.58% K) dan baja bukan organik (15% N: 6.55% P: 12.45% K). Sub-plot berdasarkan varieti Medan dan Pontian. Aktiviti fisiologi yang dapat diperhatikan pada 4 dan 7 bulan selepas ditanam. Daun muda dan ubi dituai 9 bulan selepas menanam dan dianalisa untuk sebatian fitokimia.

Hasil tertinggi dan diameter ubi terbesar diperhatikan dalam tumbuhan dirawat dengan baja organik. Klorofil tertinggi diperolehi daripada tumbuhan dirawat dengan vermikompos. Antara varieti, hasil tertinggi telah diperolehi daripada Pontian. Terdapat interaksi positif antara sumber baja dan varieti dari segi hasil, diameter ubi, kandungan klorofil relatif, pengawalan stomata dan kadar fotosintesis.

Hasil kajian juga menunjukkan bahawa ubi kayu dirawat dengan VWV memberikan prestasi yang terbaik bagi asid askorbik, jumlah karotenoid, jumlah sebatian fenolik, dan jumlah flavonoid dan aktiviti antioksidan manakala baja bukan organik meningkatkan tahap glikosida sianogenik dalam ubi dan daun. Jumlah kandungan fenolik dan flavonoid didapati jauh lebih tinggi ($P \leq 0.01$) dalam rawatan VWV daripada baja mineral dan EFBC. Jumlah sebatian fenolik meningkat sebanyak 15% dalam daun dan ubi yang telah dirawat dengan VWV berbanding EBFC. Antara

varieti, Medan mengandungi kandungan fitokimia yang lebih tinggi berbanding dengan Pontian.

Aktiviti pengoksida DPPH and FRAP telah menunjukkan bahawa Medan dengan penggunaan vermikompos menunjukkan peratus perencatan lebih tinggi. Penggunaan vermikompos dan EFBC boleh meningkatkan aktiviti antioksidan. Daun Medan menunjukkan aktiviti antioksidan yang lebih tinggi daripada Pontian. Kandungan sianida dalam semua rawatan menunjukkan perbezaan yang signifikan bagi kedua-dua daun dan ubi. Sejumlah relatif yang rendah kandungan sianida didapati pada ubi kayu di mana kompos telah digunakan. Kajian ini jelas menunjukkan bahawa pembajaan dan varieti mempunyai pengaruh yang ketara ke atas hasil, aktiviti fisiologi dan kandungan fitokimia dalam ubi kayu.

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I certify that an Examination Committee has met on **4th February 2013** to conduct the final examination of Nur Faezah Binti Omar on her Master of Science thesis entitled “PHYTOCHEMICAL COMPOUNDS IN CASSAVA (*Manihot esculent* Crantz) Var. MEDAN AND PONTIAN INFLUENCED BY SOURCES OF FERTILIZER” in accordance with Universiti Putra Malaysia (Higher Degree) Act 1980 and Universiti Putra Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the student be awarded the Master of Science.

Members of the Examination Committee were as follows:

Adam Puteh, PhD

Associate Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Chairman)

Mohd Rafii Yusop, PhD

Associate Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Internal Examiner)

Phebe Ding, PhD

Associate Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Internal Examiner)

Normaniza Osman, PhD

Associate Professor
Faculty of Science
Universiti Malaya
(External Examiner)

NORITAH OMAR, PhD

Associate Professor and Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 26 June 2013

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

Siti Aishah Hassan, PhD

Associate Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Chairman)

Nur Ashikin Psyquay Abdullah, PhD

Senior Lecturer
Faculty of Agriculture
Universiti Putra Malaysia
(Member)

Umi Kalsom Yusuf, PhD

Professor
Faculty of Sciences and Technology
Universiti Putra Malaysia
(Member)

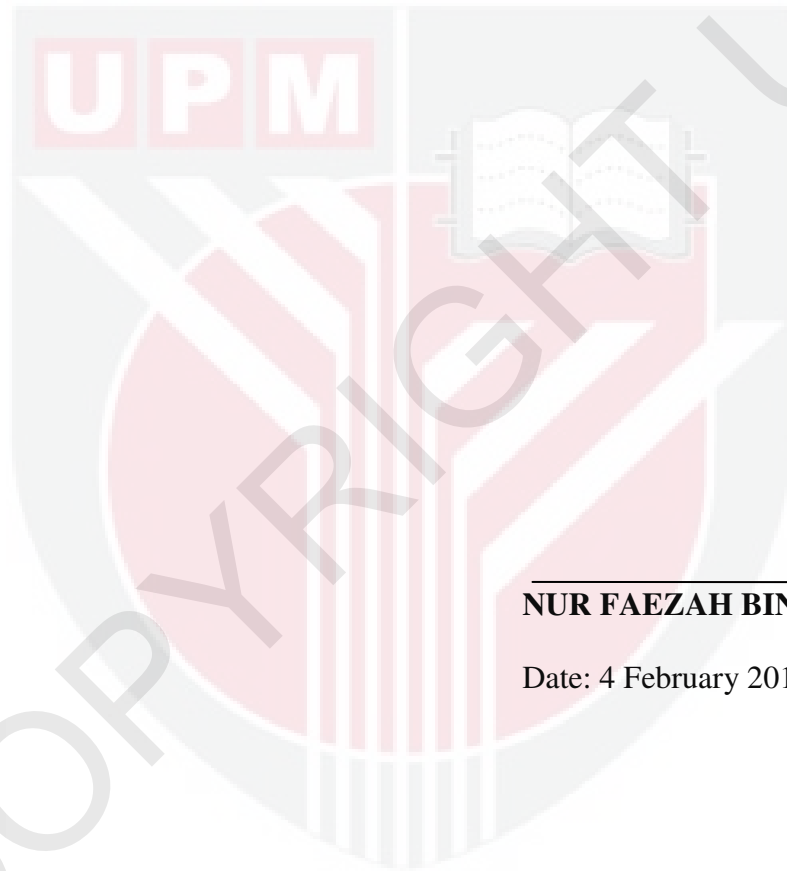
BUJANG BIN KIM HUAT, PhD

Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.



NUR FAEZAH BINTI OMAR

Date: 4 February 2013

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